THE BIG BEND REGIONAL AEROSOL AND VISIBILITY OBSERVATIONAL (BRAVO) STUDY: A PRELIMINARY FACT SHEET

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Introduction:

The Big Bend Regional Aerosol and Visibility Observational (BRAVO) Study is a multiyear monitoring and assessment study of the causes of haze in the vicinity of Big Bend National Park, Texas (BBNP). The Study was performed in response to public reports of decreased visibility at the Park, historical data showing decreased visibility, and the construction of two coal-fired power plants in Mexico, approximately 130 miles southeast of the Park. The BRAVO Study was designed to apply state-of-the-art science to identify and, if possible, quantify contributions to haze at BBNP from the source regions and source types that could be contributors to the haze. The BRAVO Study was not designed or intended to be the basis, in and of itself, for any regulatory action. However, information from BRAVO could be useful to States in planning for the requirements of the U.S. Environmental Protection Agency's Regional Haze Rule or other State legislative mandates.

Overall direction for the BRAVO Study is the responsibility of the BRAVO Study Steering Committee composed of representatives from the U.S. Environmental Protection Agency, the U.S. National Park Service, and the Texas Commission on Environmental Quality.

The BRAVO Study included an extensive four month monitoring program from July through October 1999, with air quality, meteorology and haze measurements at locations throughout the State of Texas. Although officially invited, Mexico declined to participate in or provide information to the study. For more information about the Study background, one may consult the BRAVO web site at:

http://www2.nature.nps.gov/ard/bravo/

To increase confidence in its results, the BRAVO Study is employing different impact assessment techniques, including regional air quality modeling and a series of back-trajectory and receptor modeling analyses. This variety of approaches will allow an evaluation of the performance of the various analytical techniques and a determination of if and how they should be combined to develop scientifically supportable conclusions.

The information presented below includes results solely from the back-trajectory and receptor modeling components of the study. This information should be considered preliminary.

Preliminary analysis information:

Big Bend Aerosol and Optical Measurements:

- Time plots of light extinction and scattering, and the major aerosol species (sulfate, organic carbon, elemental carbon, nitrate, fine soil, and coarse mass) show that there were four major visibility-reducing episodes during the July-October 1999 study period.

- The fine particle mass budget for BBNP shows that sulfate particles dominate the visibility haze, followed in importance by carbon and soils. During the BRAVO Study period, most of the haze was caused by sulfate aerosol with much less from the other aerosol species.

- Periods of elevated soil concentrations that contribute to visibility impairment include some episodes of African dust as determined by compositional differences, back trajectory analysis, and satellite data, although such dust is not, on average, a major contributor to BBNP haze.

- From an attribution technique that compares the concentrations of sulfate and sulfur dioxide at neighboring monitoring sites, we can estimate that, on average, the majority of the sulfur dioxide is from nearby sources. By contrast and on average, the majority of the sulfate particles at BBNP is from more distant sources.

- Spatial patterns of sulfate across the Study area suggest that the highest sulfate levels at BBNP -- that is, those during episode conditions -- are associated with sources along the U.S.-Mexico Border, in Mexico, and to the north and east of Big Bend, including those in Texas and the Eastern U.S.

Transport Assessments:

- Back trajectory analyses suggest that during the study period air was often transported to BBNP from the southeast, with flow along the Texas-Mexico border.

- The study period was selected to allow monitoring of conditions when the wind flow patterns were from the south as well as from the east and northeast. However, this was a period in which the frequency of wind flow from the east and northeast was increasing.

- Back trajectory analyses also suggest that high sulfur particulate episodes at BBNP are frequently associated with air that travels over East Texas and U.S. States further north and east and then over the U.S.- Mexico border area before arriving at BBNP, but a statement of the relative contributions of these source areas should be made only after all modeling results are available. These air trajectories were relatively uncommon during the July-October 1999 period, but when they did occur, higher sulfur particulate levels were more likely at BBNP.

- Trajectory regression analysis indicates that, for the July-October 1999 study period, sources in the eastern part of Texas and northeastern Mexico may be responsible for a similar amount of contribution to the BBNP haze when the accuracies of the analysis techniques are considered. These are preliminary results that must be re-examined when regional air quality modeling results are reported.

Air Quality Modeling Assessments:

- The Regional Modeling System for Aerosols and Deposition (REMSAD) and the Community Multiscale Air Quality (CMAQ) Model are being used in an attempt to assess the contributions to sulfur at BBNP from Mexico, eastern Texas, western Texas, U.S. States other than Texas, and a number of sub regions of these. Modeling scenarios and reconciliation tasks are now underway.

For more information, please contact:

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